



PPG Industries, Inc. Box 191 New Martinsville, West Virginia 26155 (304) 455-2200

Natrium Plant
Chemicals Group

February 2, 1990

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

Director, Hazardous Waste Management Division
U.S. EPA, Region III
841 Chestnut Building
Philadelphia, PA 19107

Dear Sir:

**Re: Verification Investigation Report for Corrective Action
& Waste Minimization Permit WVD 004336343**

The United States Environmental Protection Agency issued Corrective Action and Waste Minimization Permit Number WVD 004336343 to PPG Industries, Inc's Natrium plant effective November 4, 1987.

Permit condition II.B.1 required PPG Industries, Inc. to submit a Verification Investigation Work Plan for seven (7) units. This was accomplished and the plan was submitted June 15, 1989. Permit condition II.B.2 required PPG Industries, Inc. to execute the approved plan and report the results and recommendations based on these results by February 7, 1990.

PPG hired International Technology Corporation to prepare and execute the plan and to prepare a report of the program results and recommendations for further work. Three copies of that report are enclosed.

PPG Industries, Inc and IT Corporation are available to review the report with the Agency or answer questions by phone at any time.

Sincerely,

Kenneth S. Walborn
Kenneth S. Walborn
Manager, Environmental Control

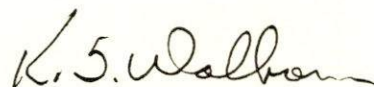
Attachments - 3 copies

cc: B. Douglass Steele, Chief - 1 copy
WV Department of Natural Resources
Division of Waste Management
1260 Greenbrier Street
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Mr. Robert C. Holden
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Verification Investigation Report Certification

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to be the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.



K. S. Walborn
Manager, Environmental Control

VERIFICATION INVESTIGATION REPORT
PPG NATRIUM PLANT
NEW MARTINSVILLE, WEST VIRGINIA

February 5, 1990

Prepared for PPG Industries, Inc.
by IT Corporation

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Date 2/5/90

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Date 2/5/90

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Date 2/5/90

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1.0 PURPOSE OF INVESTIGATION

This report contains the results of the Verification Investigation conducted at the PPG Industries, Inc. (PPG), Natrium plant by IT Corporation (IT). The Verification Investigation was conducted in accordance with the requirements set forth in permit condition II.B of the U.S. Environmental Protection Agency (U.S. EPA) Resource Conservation and Recovery Act (RCRA) corrective action and waste minimization Permit No. WVD 004336343. This condition of the permit required PPG "to conduct an initial investigation with the objective of verifying whether releases have or have not occurred from seven solid waste management units."

Specifically, PPG was required to develop and implement a groundwater investigation to determine whether further investigation or remediation is warranted based on analysis of groundwater and soil samples for the parameters as indicated in Section II.B.1.b(3) of the RCRA permit. The comparison criteria developed for the parameters in Section II.B.1.b(4) of the RCRA permit are hereafter referred to as "criteria." To accomplish this objective, groundwater samples were collected from newly installed and existing monitoring wells strategically located about each Solid Waste Management Unit (SWMU). Similarly, where required, soil samples were also collected from strategically located upgradient and downgradient positions. The seven areas investigated under this Verification Investigation include:

- Marshall Plant Waste Pond (SWMU No. 5)
- Inorganics Waste Pond (SWMU No. 6)
- Barium Waste Landfill (SWMU No. 7)
- Benzene Hexachloride (BHC) Waste Pile (SWMU No. 8)
- Fly Ash Landfill cells which received barium waste (SWMU No. 10)

- Sanitary Landfill (SWMU No. 11)
- Mercury Wastewater Collection Tanks (SWMU No. 14)

This report discusses the field methodology and data acquisition procedures implemented for performance of the Verification Investigation and presents conclusions and recommendations based on the results of the Verification Investigation.

The subsequent chapters of this report are presented as follows:

- Chapter 2.0 - Background History and Site Conditions
- Chapter 3.0 - Project Investigative Tasks
- Chapter 4.0 - Project Data Analysis
- Chapter 5.0 - Conclusions
- Chapter 6.0 - Recommendations

2.0 BACKGROUND HISTORY AND SITE CONDITIONS

The information presented in this chapter was obtained from a review of file material provided by PPG, Appendix A of the U.S. EPA Permit for Corrective Action, site visits conducted by IT on June 2, 1987 and April 13, 1989, and information acquired coincident with the Verification Investigation field activities performed by IT during the period September 11 through October 20, 1989.

2.1 LOCATION

The PPG Natrium facility is located along the eastern bank of the Ohio River approximately 30 miles south of Wheeling, West Virginia and 6 miles north of New Martinsville, West Virginia in Marshall County. The plant is situated on the northern part of the Wells Bottom area, which is an alluvial deposit of sediments along a meander on the river. This tract of land is heavily industrialized with Mobay Chemical Company and Air Products and Chemicals, Inc., occupying the remainder of the Wells Bottom area south of the PPG facility. The site is bordered by the Ohio River to the west and steep forested ridges to the east. Figure 1 provides a general map of the facility.

2.2 ENVIRONMENTAL SETTING

The PPG Natrium plant is located on floodplain and river terrace features comprised of alluvial deposits. The terraces are developed from Pleistocene glacial outwash deposits that have been downcut by various stages of the Ohio River. The terraces are characterized by coarse sand and silt. Surficial sediments of lower terrace features contain increasing amounts of silt and clay, which probably represent recent floodplain deposits.

There are three primary terrace levels at the PPG facility with elevations averaging 630, 660, and 690 feet above mean sea level (MSL). A small localized terrace is present at the site of the closed Mercury

Surface Impoundment (Unit 1) with an elevation of approximately 715 feet MSL. The terraces are bounded on the east by steep valley walls that rise to an elevation of over 1,300 feet.

The Ohio River is the major surface water body within the immediate vicinity of the facility. A tributary, Sims Run, drains property to the east of PPG and joins the river at the north (upstream) end of the PPG property. This tributary does not receive runoff from facility operations as it is separated from the operations area by a steep bedrock ridge. The latest established 100-year flood level is at an elevation of 641 feet MSL for the region. Although the manufacturing area is located outside of the floodplain, four SWMUs, namely, the Fly Ash Landfill, the closed Marshall Plant Waste Pond, the BHC Waste Pile, and the Barium Waste Landfill, are located within the 100-year floodplain (Figure 1). The Ohio River has a mean flow rate of 24,000 cubic feet per second (cfs) and a low flow rate of 5,300 cfs. A downstream lock, the Hannibal Dam, controls the water level and keeps river pool elevations between 620 and 624 feet MSL during normal flow periods.

The PPG Natrium facility utilizes groundwater from the alluvial river sediments underlying the site known as the Ohio Valley water table aquifer. These sediments exhibit an estimated hydraulic conductivity of 10^{-1} centimeters per second (cm/s) or greater. Previous studies have demonstrated that the natural groundwater flow from the high land in the east towards the Ohio River has been partially intercepted by facility pumping. Presently, groundwater flow is from the river toward plant property, and flow within the plant boundary is radial under the influence of several centers of pumping (Figure 1).

A detailed discussion of the site geology and hydrogeology as determined during the Verification Investigation is provided in Chapter 4.0.

2.3 CLIMATE

The climate within the study area is characterized as humid continental with an average annual temperature of 54.3 degrees Fahrenheit. January is usually the coldest month (average temperature of 33.1 degrees Fahrenheit) while July is usually the warmest (average temperature of 75.2 degrees Fahrenheit). Annual precipitation averages 42 inches per year, with the majority of the total precipitation occurring in the summer months. Snowfall averages 21 inches per season while the frost-free period usually extends from late April to mid-October.

2.4 HISTORY OF RELEVANT SWMUs

The following sections present a description of the past operating practices for each of the SWMUs subject to the Verification Investigation. A tabulation of wastes historically stored at each SWMU is presented in Table 1.

2.4.1 Marshall Plant Waste Pond

PPG purchased the Marshall Plant in May 1969 after first leasing it from the federal government. The unit was apparently built with clay walls and bottom. This facility was originally constructed by and used by the federal government (U.S. Department of Defense) as part of a federal facility and possibly used by other former operators who held leases prior to PPG. This unit was used by PPG as a disposal site for waste streams from a chloralkali plant, chlorinated benzene plant, and titanium tetrachloride plant.

The general dimensions of the unit are 275 by 220 feet with a capacity of approximately 18,000 cubic yards (cy). The unit was closed in 1980 with the installation of a six- to eight-inch-thick soil cover.

Aromatic and aliphatic chlorinated organics may be present in this unit. However, the potential quantity and extent of any possible migration are unknown.

2.4.2 Inorganics Waste Pond

This unit accumulated sludge from a barium process plant from 1962 to 1972. The accumulated sludge was periodically transferred to the Barium Waste Landfill during 1963 and to Cells Nos. 1 and 2 of the Fly Ash Landfill from 1963 to 1972. The unit served as a settling pond for wastewater before the water was discharged through a National Pollutant Discharge Elimination System (NPDES) permitted outfall (No. WV0004359). The pond was constructed of excavated earthen walls and floor; there were no raised dikes and the pond's dimensions were approximately 225 by 140 feet with a capacity slightly over 7,000 cy. The unit was closed in 1980, refilled to grade with clean soil, and an eight-inch-thick soil and clay cover installed.

2.4.3 Barium Waste Landfill

During 1963, this unit was used to dispose of solid wastes from a barium carbonate/chloride plant. The disposal site was constructed of excavated earthen sides and base. The dimensions of the unit were approximately 200 by 200 feet with a capacity of 5,500 cy. The site was closed in June 1980 and capped with a minimum six-inch-thick soil cover and seeded.

2.4.4 Benzene Hexachloride (BHC) Waste Pile

This unit stored BHC isomers and other waste products of the process that produces concentrated BHC. This storage site was constructed in 1952 as an open pile on earthen fill with a capacity of 1,900 cy. The dimensions of the unit were 75 by 150 feet. From 1952 through 1962, approximately 330,000 pounds per year of BHC isomers were stored here. In 1977, solid waste and contaminated soil were removed from this unit and sent to an approved landfill.

2.4.5 Fly Ash Landfill

This unit consists of five separate disposal cells. Two of these cells received barium plant waste from 1963 to 1972, as well as boiler fly ash

and bottom ash. Presently, four of the five cells, including the cells that received barium waste, are inactive and capped with six inches of soil and seeded. The fifth cell is presently accepting ash disposal under West Virginia Water Pollution Permit No. IWL-6313-86. The unit as a whole has received approximately 704,000 tons of ash since 1952.

2.4.6 Sanitary Landfill

This unit is a Class III nonchemical Sanitary Landfill for general trash, rubbish, demolition, and construction refuse operating under an August 16, 1978 West Virginia Department of Health Permit No. 7192. The unit consists of three adjacent disposal sites that are constructed of a sandy-clay loam soil. The unit's dimensions are approximately 1,000 by 500 feet with a capacity of about 35,000 tons. Nonchemical wastes are collected five days per week from approximately 50 dumpster bases located throughout the plant. There are currently 22,000 tons of waste in the landfill.

2.4.7 Mercury Wastewater Collection Tanks

This unit consists of three rubber-lined carbon-steel tanks, with dimensions as follows:

TANK	DIMENSIONS (diameter x height)	CAPACITY (gallons)
Brine Field Collection Tank	8' x 19'6"	7,300
Mercury Cell Collection Tank	14' x 20'	23,000
Small Sump Collection Tank	7'-6 x 4'	1,300

Effluents from the Brine Field Collection Tank and the plant's Mercury Cell Collection Tank are pumped to the mercury treatment system. After treatment, the system effluent is gravity fed to the main plant outfall. The third small sump collection tank receives precipitation from the large collection tank area. This runoff is pumped back to the Mercury Cell Collection Tank and then to the treatment system. The units were put into service in 1970, and PPG has no closure date planned for

them. The units are enclosed tanks that rest on a paved area with curbing. The sump collection tank is in a concrete sump.

3.0 PROJECT INVESTIGATIVE TASKS

The following is a discussion of the field activities which were performed during the Verification Investigation at the PPG Natrium site. The field program was implemented in accordance with the Verification Investigation Work Plan, Natrium Plant, New Martinsville, West Virginia, Revision 1 dated July, 1989, prepared by IT and approved by the U.S. EPA. The work scope included the installation of strategically located (i.e., upgradient and downgradient) groundwater monitoring wells about each SWMU under investigation, permeability testing of all newly installed monitoring wells, collection and analysis of groundwater and soil samples, and surveying (location and elevation) of all newly installed monitoring wells.

3.1 MONITORING WELL INSTALLATIONS

The Verification Investigation at the PPG Natrium site included the installation of a total of 21 monitoring wells strategically located about the SWMUs of concern. Monitoring well installation activities occurred during the period September 11 through September 30, 1989. Placement of the newly installed monitoring wells was selected to fulfill the specified requirements of the Verification Investigation Plan, specifically, to be able to assess whether migration of hazardous constituents has or has not occurred from each of the SWMUs identified for this investigation. In an effort to ensure that monitoring wells were properly positioned about each SWMU with respect to upgradient and downgradient locations, a thorough review of available hydrogeological data was conducted, including the collection of water level data from existing monitoring and pumping wells (April 13, 1989) from which an updated groundwater contour map could be constructed and compared with previous contour/flow direction maps. Additionally, existing monitoring wells were evaluated as to their suitability (i.e., condition and location) for inclusion in the Verification Investigation. Because monitoring well placement was specific to each SWMU, all of the

following factors were addressed prior to the actual installation of a monitoring well:

- Location and condition of any existing monitoring wells, including screen length and screen position relative to normal groundwater levels, which potentially could be utilized during the Verification Investigation
- Location of pumping wells and their influence, if any, on the selection of upgradient and downgradient monitoring well locations
- Review of historical hydrogeologic data, including a comparison of "wet" and "dry" season groundwater levels and flow directions
- General well design and placement requirements of both the U.S. EPA (as defined in the RCRA Technical Enforcement Guidance Document, September 1986) and the West Virginia Department of Natural Resources (DNR)
- Presence of existing cultural features throughout the plant (e.g., railroad tracks, roadways, buildings, etc.) which would interfere with monitoring well placement

3.1.1 Drilling Methods

As all monitoring wells were installed within unconsolidated alluvial deposits of sand, silty-to-sandy clay, and pebbles, all boreholes drilled during this investigation were advanced through the use of 4.25-inch-inside-diameter (I.D.) hollow-stem augers. All boreholes were advanced to a depth of 15 feet below the depth at which groundwater was encountered at each borehole location. Drill cuttings generated at each location during borehole advancement were placed in drums and appropriately labeled as to which location they were derived from and on what date they were containerized. All drums were eventually moved to an on-site storage area, where soil samples were collected from each drum and analyzed for the constituents of concern at each SWMU. All analytical results for these samples were negative with respect to their respective analytes, with the exception of that soil derived from drill

cuttings generated within the vicinity of the BHC Waste Pile (SWMU No. 8). Cuttings derived from SWMU No. 8 have been appropriately labeled and were staged for off-site disposal.

During the advancement of boreholes, lithologic samples were collected at five-foot intervals through the use of standard two-inch-outside-diameter (O.D.) split-spoon samplers. All Standard Penetration Tests (SPTs) were performed in accordance to the specifications outlined in American Society for Testing and Materials (ASTM) Procedure D1586, "Standard method for Penetration Test and Split-Barrel Sampling of Soils." Upon retrieval of a split-spoon sample, an IT field geologist visually classified the sample using the Unified Soil Classification System (USCS) and recorded the information on a boring log. Archive samples were collected from each sample interval and placed in airtight glass containers for future reference. An HNu photoionization meter or equivalent was used to monitor air quality at each borehole location during drilling and sampling activities. Copies of all boring logs prepared by the IT field geologists during the Verification Investigation appear in Appendix A.

3.1.2 Construction of Monitoring Wells

After a borehole had been advanced to the desired depth (i.e., 15 feet below the level at which groundwater was first encountered), a 2-inch-diameter monitoring well was installed through the hollow-stem augers. Monitoring wells installed during the Verification Investigation were constructed of a 20-foot section of Schedule 40 polyvinyl chloride (PVC) 0.010-slot screen and an appropriate length of threaded flush-joint Schedule 40 PVC riser pipe in accordance with U.S. EPA specifications. The well screens were set such that the water table surface would be intercepted during both wet and dry seasons (e.g., an allowance was provided for seasonal variances and changes in pumping rates). As the monitoring wells were installed during the dry season, an additional five feet of screen was installed above the water table as it existed

during the time of well construction. Monitoring well construction diagrams are provided in Appendix B. The remainder of the monitoring well installation proceeded as follows:

- Backfilling of the borehole, if necessary, with clean sand to the desired depth of the bottom of the well screen (i.e., in some locations boreholes were overdrilled to allow for the effects of "heaving" sands).
- Emplacement of clean, coarse, quartz sand (i.e., filter pack) within the annulus between the well screen and the borehole wall to a depth approximately two feet above the top of the well screen to form the well sensing zone; the sand was steadily trickled through the hollow-stem augers as they were gently pulled to the surface, thereby eliminating the introduction of undesired fine-grained sediments due to potential borehole collapse. A sample of the sand used to form the well sensing zones was submitted to a geotechnical laboratory for grain size analysis. Results are presented in Appendix C.
- Sealing of the well sensing zone with two feet of sodium bentonite pellets (the pellets were emplaced in the same manner as was the filter pack); as the pellets were installed above the saturated zone, they were manually hydrated with potable water to permit proper expansion
- Grouting of the remainder of the well annulus with a cement/bentonite grout to just below the frost line through the use of tremie pipe.
- Installation of a locking protective steel casing cemented around the top of the riser pipe followed by the emplacement of a four-inch-thick, three-foot-diameter concrete apron; lockable, watertight, surface flush-mounts were installed in place of the protective steel casing on three of the monitoring wells as they were situated in high-traffic areas
- Installation of protective bumper pipes around all monitoring wells which extended above the ground surface; all bumper pipes and surface protective casings were painted high-visibility yellow; appropriate identification numbers were painted on each well

Although the RCRA Groundwater Monitoring Technical Enforcement Guidance Document suggests using teflon or stainless steel for the monitoring well screen, PVC well screen was used for all monitoring wells installed during the Verification Investigation. As stated in the work plan, the presence of any substances which may be detrimental to PVC (e.g., aromatic hydrocarbons) had only been encountered at levels which would have no effect on PVC, thereby permitting its use in the construction of monitoring wells at the PPG Natrium facility. Similarly, in accordance with the rationale discussed in the work plan, only the uppermost portion of the alluvial aquifer was screened during the Verification Investigation. Locations of all monitoring wells installed during the Verification Investigation as well as existing monitoring wells are shown in Figure 1.

3.1.3 Monitoring Well Development

After the grout used to seal the annular space in each monitoring well was permitted to set a minimum of 24 hours, each newly installed monitoring well was developed using a "Well Wizard" air ejector pump. The pump was operated in an intermittent manner to permit flow reversals and surges within the monitoring well sensing zone, thereby eliminating the possibility of bridging of particles against the well screen. Each well was pumped until a sample of ejected water, when placed in a clear glass container, did not contain any visible solids. All water discharged during the development process was collected in 55-gallon drums which were appropriately labeled and identified. The drums were moved to an on-site staging area until the chemical analyses of samples collected from that well were available. At that time, the drummed water was disposed of in a manner dictated by the groundwater quality data (i.e., either disposed of on site or sent to an off-site licensed disposal facility).

Although it was intended that water levels be measured immediately before and after development of each well (as well as 24 hours after

development), recharge to the wells was almost instantaneous thereby preventing the collection of accurate data. In most cases, all wells were recharged to their original static water level within minutes. Recharge data were recorded during the permeability testing phase of the Verification Investigation (Section 3.2), however, and a complete set of groundwater level data of all new and existing wells was collected within a 10-hour period at the time of groundwater sampling (Section 3.4.1).

3.1.4 Decontamination Activities

All drilling equipment used during the Verification Investigation was decontaminated with a high-pressure steam cleaner prior to beginning any drilling activities and between successive boreholes thereafter. Water used in the decontamination process was obtained from an on-site potable water source. All downhole drilling equipment (e.g., bits, augers, rods, etc.) were further decontaminated between boreholes by a methanol rinse followed by a rinse with distilled water.

Although the original work plan stated that hexane was to be used in the decontamination process, methanol was substituted due to the tendency of hexane to be present as a laboratory contaminant in the analytical results. This substitution was orally authorized by Ms. Mary F. Beck, U.S. EPA Region III, on September 13, 1989. A letter confirming this authorization was prepared by Mr. Kenneth S. Walborn of PPG and sent to Ms. Beck on September 14, 1989.

Split-spoon samplers were decontaminated between each use directly at the borehole site. The decontamination procedure for split spoons consisted of:

- Scrub-off of visible debris with soapy water (Alconox)
- Rinse in potable water

- Rinse with methanol
- Rinse with distilled water

Additionally, the monitoring well riser pipe and well screen were steam cleaned prior to insertion into a borehole. This ensured that all cutting oils, greases, and wax would be removed from the well construction materials. Similarly, materials used in the well development process (e.g., pump and tubing) were also steam cleaned between use in each borehole to further prevent cross contamination.

Water used at the borehole site for decontamination purposes was returned to the primary decontamination area, which consisted of a "Vis-Queen" lined trough. Water and soil generated during the decontamination process were routinely pumped and shoveled into drums and staged at a central location. These wastes were then disposed of as previously described for the drill cuttings (Section 3.1.1) and the development water (Section 3.1.3).

3.2 PERMEABILITY TESTING

Hydraulic conductivity testing of the newly installed monitoring wells was performed on October 10, 1989 by IT. The test method used was a falling head slug test with changes in water level noted through the use of an electronic recorder. A falling head slug test consists of measuring the time necessary for a well to recover to its original static water level after a change in the water level has been induced through the introduction of a slug. Time and water level measurements were recorded by an electronic instrument, the Hermit datalogger. Slugs used in the tests were constructed of one-inch-O.D. stainless steel (4.99 and 7.36 feet in length) and were lowered into a monitoring well by a polypropylene rope.

Prior to conducting the test, the water level in each well was determined using an M-scope electronic water level meter. The water level

data along with well construction data were used to determine the length of the slug that could be used to conduct the test, depth to which the slug should be dropped, and the placement of the pressure transducer which measured the change in water level during the test. After the pressure transducer was placed in the well and the water level in the well was permitted to stabilize, the Hermit datalogger was programmed with the specific data for the well and the test initiated by simultaneously starting the Hermit and dropping the slug into the water. The data recorded by the Hermit were observed by the operator, and the test was concluded when the water level in the well was within 0.02 foot of the initial static water level. The data were then reviewed by the operator for completeness and stored in the Hermit's internal memory. At the end of the day, the field data were transferred to a portable computer and stored on a disk. Analysis of the field data was completed upon return to the IT office. The results of the conductivity testing are discussed in Section 4.1.

3.3 SURVEY OF MONITORING WELLS

The 21 monitoring wells installed as part of the Verification Investigation at the PPG Natrium site were surveyed on October 20, 1989 by a licensed surveyor, Territ's Survey Services of Pittsburgh, Pennsylvania. Each newly installed monitoring well was surveyed to establish horizontal well location, elevation at top of PVC riser, elevation at top of protective surface casing (if applicable), and ground surface elevation at each well location. Horizontal and vertical readings were electronically calculated to 0.001 of a foot and recorded by a theodolite. Map coordinates were determined using the plant coordinate system (Table 2). The survey data were converted to Universal Transverse Mercator coordinates, the accepted system used by the U.S. Coastal and Geologic Survey (USC & GS), by the surveyor based on information supplied to IT by PPG (Table 3). The locations of all newly installed monitoring wells, existing monitoring wells, and existing pumping wells have been plotted on a base map which utilizes the plant coordinate system (Figure 1).

3.4 GROUNDWATER AND SOIL QUALITY SAMPLING

The Verification Investigation groundwater monitoring task was initiated by IT on October 16, 1989 and concluded on October 18, 1989. Groundwater samples were collected from 21 newly installed monitoring wells (identified as MW-100 through MW-120) and from two existing monitoring wells (MW-5 and MW-32). Two additional existing monitoring wells (MW-10 and MW-16) were scheduled to be sampled during the Verification Investigation. However, these wells were found to be internally damaged and could not yield representative samples. In addition to the collection of groundwater samples, this task included the recording of water level data from all newly installed and existing monitoring wells within one 10-hour period. This information is presented in Table 4 and was used in the preparation of the groundwater contour map (Figure 1).

In accordance with the revised Verification Investigation work plan, nine soil samples were collected from biased sampling locations (with respect to topography, piping systems, tank bottoms, etc.) within the immediate vicinity of SWMU No. 14 (Mercury Wastewater Collection Tanks). These samples were submitted to the laboratory and analyzed solely for the presence of mercury. Soil samples were collected on September 20, 21, 22, and 26, 1989.

3.4.1 Groundwater Sampling Procedures

Immediately upon opening a monitoring well to be sampled, the air in the well headspace was monitored for the presence of organic vapors with a Photovac TIP III. The static water level and the depth to the bottom of the well were then measured to the nearest 0.01 of a foot using an M-scope electronic water level meter. The M-scope was decontaminated between sampling locations by a distilled water-methanol-distilled water rinse. The height of standing water within the well was then determined, and the volume of water to be purged from the well was calculated.

A minimum of three well volumes was removed from each monitoring well prior to sample collection, as suggested on Page 103 of the RCRA Groundwater Monitoring Technical Enforcement Guidance Document, September 1986 for high yielding wells. All monitoring wells were purged from the top of the water column through the use of a teflon bailer, which was decontaminated between monitoring wells in accordance with the methodology described in Section 3.1.4. New nylon bailing cord was used at each well location. All monitoring wells purged during the Verification Investigation experienced rapid, if not immediate, recharge.

Groundwater samples were collected with a teflon bailer equipped with double-check valves and a bottom-emptying device (petcock-type assembly). Although nondedicated bailers were utilized for sample collection, each bailer was disassembled and decontaminated (per the procedure outlined in Section 3.1.4) between sampling events. New nylon cord was used at every well sampled to further minimize the potential for cross contamination between any of the wells. Where applicable, samples for volatile organics were collected first, with the samples contained in U.S. EPA approved 40-milliliter (mL) vials with teflon-lined silicone rubber septa. An aliquot of sample to be utilized for the field measurement of time-sensitive physical parameters which included temperature, pH, and conductivity was collected next. Physical parameters were measured in the field using a conductivity meter, thermometer, and pH paper. Groundwater sampling continued at each well location utilizing the following collection hierarchy:

- Semivolatiles
- Total organic carbon (TOC)
- Total organic halogen (TOX)
- Total metals

All samples were contained in the appropriate U.S. EPA-approved sample bottles and immediately placed in an ice chest maintained at approximately 4 degrees Celsius for overnight shipment to the IT laboratory in Export, Pennsylvania.

To check on sample handling and the thoroughness of field equipment decontamination, three types of quality control samples were routinely collected. A trip blank, which consisted of a deionized water sample prepared in the laboratory, accompanied the sample containers to the field and back to the laboratory to monitor for possible sample contamination which may have occurred while the samples were enroute to the laboratory. One trip blank was analyzed during this sampling event as recommended in the RCRA Groundwater Monitoring Technical Enforcement Guidance Document, September 1986. Field blanks were prepared for each day that samples were collected to monitor the effectiveness of the field decontamination procedures. Field blanks were prepared by filling a decontaminated, nondedicated teflon bailer with distilled water and then transferring the distilled water from the sampling device to the sample bottles. Field blanks accompanied each day's sample shipment. The third type of sample collected for quality control (QC) purposes was a duplicate. Duplicate samples were collected at two locations and were assigned different sample identification numbers than the original samples. Duplicate samples were utilized to determine the precision of the analytical method for the sample matrix.

3.4.2 Soil Sampling Procedures

During the advancement of the three boreholes for the installation of monitoring wells at SWMU No. 14 (Mercury Wastewater Collection Tanks), soil samples were collected at depths of 6 to 12 inches below ground surface and at a depth just above the water table. Soil samples were collected with a split-spoon sampler as described in Section 3.1.1. Since selected samples from these boreholes were to be submitted to the laboratory and analyzed for the presence of mercury, the split-spoon samplers were decontaminated between each use to prevent cross contamination between sample intervals. Methodology used in the decontamination of split-spoon samplers is discussed in Section 3.1.4.

Upon arrival at the desired interval, a sample of the soil from that interval was placed into a clean glass container which was labeled with the following information: project name and number, sample location, sample identification number, depth interval, date of collection, and name of individual collecting the sample. Immediately after collection, the samples were placed in an ice chest and cooled to an approximate temperature of 4 degrees Celsius.

In addition to the collection of soil samples from the borings, three additional, strategically located soil samples were collected in the immediate vicinity of the wastewater collection tanks. Two of the samples (designated as SS-1 and SS-2) were collected at points which were topographically low with respect to the tank bottoms while the third sample (identified as SS-3) was collected from a point which was topographically upgradient from the collection tanks. These surface soil samples were collected from depths of 6 to 12 inches below ground surface after an approximate 6- to 8-inch layer of gravel had been scraped away. Samples were collected with a decontaminated stainless steel spoon and placed in clean glass jars which were appropriately identified. The samples were then placed in an ice chest and prepared for shipment as described above.

Locations where soil samples were collected are shown in Figure 2. Table 5 presents a summary of soil sample identifications and the respective depths at which the samples were collected.

3.4.3 Sample Shipment

Immediately after collection, groundwater and soil samples were placed in ice chests maintained at an approximate temperature of 4 degrees Celsius and properly packed to minimize any breakage. Chain-of-Custody and Request for Analysis forms were placed in each cooler, and the cooler was sealed and labeled in accordance with DOT and U.S. EPA regulations.

Depending on the circumstances (i.e., whether or not IT personnel were returning to the Pittsburgh area), samples were either hand-delivered to the laboratory or shipped for next day delivery by Federal Express. The laboratory was informed in advance that samples would be arriving, and, once received, were instructed to sign off on the Chain-of-Custody forms which were subsequently placed in the project file after final sample disposition.

3.4.4 Laboratory Analysis

Upon arrival at the IT laboratory in Export, Pennsylvania, the samples were inspected by the sample custodian for any damage which may have occurred during transit and to ensure that the appropriate temperature had been maintained. Chain-of-Custody forms were completed and the samples were logged and reviewed for holding time limitations for the analysis to be performed. While awaiting processing, samples were stored at 4 degrees Celsius.

Groundwater and soil samples were analyzed for the compounds required under Section II.B.1.b(3) of the facility's RCRA permit. As presented in Table 6, specific parameters were to be analyzed at each SWMU. The analytical detection limits (Table 7) were intended to correspond with the criteria as set forth in Section II.B.1.b(4) of the permit. Due to elevated concentrations of certain parameters in several samples which were detected above the linear range of the GC/MS, those samples had to be diluted so that they would fall within the instrument's linear range. Consequently, the dilution process elevated the quantitation limits of those parameters present at very low or nondetect levels. As will be discussed in Chapter 4.0 of this report, the inability to meet certain analytical detection limits in all instances was not critical in the final interpretation of the data.

All sample analyses were performed in accordance with accepted U.S. EPA analytical protocol (Table 8). All of the quality assurance/quality

control (QA/QC) requirements as defined in "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods" SW-846 and the QAPP were adhered to. This included the analysis of an appropriate number of method blanks, trip blanks, duplicates, surrogate spikes, and matrix spikes with the samples.

4.0 PROJECT DATA ANALYSIS

This chapter of the report presents a summary of the hydrogeology of the PPG Natrium site as interpreted from the boring logs, aquifer testing, and measurement of groundwater levels. Also included in this section are interpretations of the analytical results of the groundwater and soil samples collected during the Verification Investigation.

4.1 HYDROGEOLOGICAL SETTING

The PPG Natrium plant is located on alluvial deposits comprised of floodplain and river terrace features. The river terraces have been developed from Pleistocene glacial outwash deposits which have been downcut by various stages of the Ohio River. The terraces are characterized by coarse sand and silt. Surficial sediments of the lower terrace features contain increasing amounts of silt and clay, which most likely represent floodplain deposits associated to the recent history of the Ohio River. Groundwater movement beneath the PPG Natrium facility is strongly influenced by the industrial pumping wells which operate throughout the plant and by the Ohio River, which borders the plant to the west.

Aquifer testing was performed on the 21 newly installed monitoring wells on October 9 and 10, 1989. As discussed in Section 3.2 of this report, a falling head test method was used permitting the hydraulic conductivity to be determined at each monitoring well location. Hydraulic conductivity data derived from these tests are presented in Table 9.

The predominant groundwater flow directions at the PPG site are from the east and west toward the center of the plant and are controlled by the industrial pumping wells. The steep groundwater gradient evident along the bank of the Ohio River (Figure 1) is attributable to the fine, low permeability material found within the area, as noted during the installation of the monitoring wells.

4.1.1 Sanitary Landfill Hydrogeology

The Sanitary Landfill is the northernmost SWMU at the PPG Natrium plant. As revealed in the boring log prepared during the installation of Monitoring Well MW-117, the subsurface at this SWMU trends from firm silt to sandy silt, becoming coarser with depth. Groundwater was encountered at approximately 40 feet below ground surface at this location. Below the depth at which groundwater was encountered, the subsurface material was comprised entirely of coarse sand and gravel, loose to medium dense. The hydraulic conductivity calculated from the field permeability falling head test executed in Monitoring Well MW-117 was 9×10^{-3} cm/s, which correlates well with the geologic subsurface description. The groundwater gradient in the immediate vicinity of the Sanitary Landfill is small but is indicative of a southerly flow direction toward the nearby industrial pumping wells.

4.1.2 Fly Ash Landfill Hydrogeology

The Fly Ash Landfill SWMU is situated in the northwestern corner of the PPG facility along the Ohio River. The five new monitoring wells completed about this SWMU (MW-112, MW-113, MW-114, MW-115, and MW-116) reveal the presence of fine geologic material such as silty clay, clayey silt, silty sand, and fine sand near the Ohio River which trends to coarser material further inland. This variation in the hydrostratigraphic unit is related to and dependent on the history of the Ohio River. As presented in Table 9, the hydraulic conductivities obtained at these monitoring wells range from 9×10^{-3} to 7×10^{-5} cm/s, which is considered to be consistent with the geologic descriptions. The local groundwater gradient is steep, on the order of 0.03 to 0.04 feet/foot (ft/ft) and is indicative of a predominant groundwater flow direction from west to east, from the Ohio River to the industrial pumping well system.

4.1.3 Marshall Plant Waste Pond Hydrogeology

The Marshall Plant Waste Pond SWMU is located immediately south of the Fly Ash Landfill. From a geologic and hydrogeologic point of view, the subsurface is almost identical to the subsurface beneath the Fly Ash Landfill: fine materials (silty clay and silty fine sand) near the Ohio River with coarser material inland. Calculated hydraulic conductivities from monitoring wells installed about this SWMU (MW-100, MW-101, and MW-102) range from 2×10^{-5} to 8×10^{-3} cm/s, with the hydraulic conductivity increasing away from the Ohio River. The main groundwater flow direction is to the east, toward the production wells. The groundwater gradient is steep, in the range of 0.03 to 0.04 ft/ft.

4.1.4 Mercury Wastewater Collection Tank Hydrogeology

The Mercury Wastewater Collection Tanks are located in the central area of the PPG Natrium plant, on the upper river terrace. The subsurface is comprised of fine-to-coarse, loose-to-dense sand and gravel, as depicted on the boring logs for Monitoring Wells MW-118, MW-119, and MW-120. Calculations based on the falling head tests in these monitoring wells reveal hydraulic conductivities in the range of 10^{-3} cm/s, which are consistent with the geologic material described in the boring logs. The local groundwater table is almost flat, with a predominant groundwater flow direction to the west, from the upper terraces of the Ohio River Valley toward the industrial production wells.

4.1.5 Inorganic Waste Pond Hydrogeology

The Inorganics Waste Pond SWMU is located in the south-central portion of the facility. The local geology, as described in the boring logs of Monitoring Wells MW-103, MW-104, and MW-105 is comprised of fine-to-medium sand, which varies from silty to gravelly. It appears that the subsurface beneath this SWMU consists of a lense of lower permeability material. This interpretation is in agreement with the relatively low hydraulic conductivities calculated in this area and with the flat localized groundwater mound shown in Figure 1. Groundwater flow beneath

this SWMU is radial, toward the production wells which surround the Inorganics Waste Pond. The local groundwater mounding effect may be a result of surface recharge in combination with the low permeability material, which has a low dissipation factor as compared to the surrounding subsurface.

4.1.6 BHC Waste Pile Hydrogeology

The BHC Waste Pile is situated adjacent to the Ohio River, to the south of the Inorganics Waste Pond. The subsurface geology as described in the boring log prepared for Monitoring Well MW-110 consists of low permeability geologic materials such as silty fine sand, silty clay, and gravelly clay. The geology is consistent with areas near the Ohio River bank, areas exposed to a siltation process in the past as well as during the flood stage of the river. The hydraulic conductivity calculated at Monitoring Well MW-110 was found to be 2×10^{-3} cm/s, which is in accordance with the material noted, and which explains the steep local hydraulic gradient (0.04 ft/ft). The local groundwater flow direction is to the east, from the Ohio River toward the production wells. To the immediate south of the BHC Waste Pile, the slope of the groundwater table is influenced by the surface topography (former creek which discharged into the Ohio River) as well as industrial Pumping Well No. 19 which is located in the immediate vicinity of this SWMU..

4.1.7 Barium Waste Landfill Hydrogeology

The Barium Waste Landfill is the southernmost SWMU at the PPG Natrium facility. It is located approximately 1,500 feet south of the BHC Waste Pile. The local geology, as described in the boring logs of Monitoring Wells MW-106, MW-107, MW-108, and MW-109, is comprised of silty clay, silty very fine sand, and loose to medium-dense sand and gravel. The groundwater has a slight gradient to the north, the predominant groundwater flow direction. A secondary groundwater flow direction is evident from the Ohio River toward the SWMU where it then merges with the predominant route of groundwater migration. The groundwater flow

direction is strongly influenced by Production Wells No. 51 and 57. It appears that the Barium Waste Landfill is situated above a channel of highly conductive materials which parallel the Ohio River. Hydraulic conductivities calculated at this location are in the range of 4×10^{-3} to 2×10^{-2} cm/s.

4.2 CONTAMINANT OCCURRENCE IN GROUNDWATER

The groundwater analytical data discussed in this section refer to the groundwater samples collected during the period October 16 to 18, 1989. In accordance with the RCRA permit, the samples were analyzed for the SWMU-specific parameters as presented in Table 6. The analytical data sheets, QA/QC documentation, and method references are provided in Appendix D.

4.2.1 Marshall Plant Waste Pond

Four monitoring wells located about the Marshall Plant Waste Pond were sampled for the Verification Investigation; of these, three were newly installed by IT (MW-100, MW-101, MW-102) while the fourth (MW-5) was an existing monitoring well installed during a previous study. As shown in Figure 1, Monitoring Wells MW-5 and MW-100 were identified as upgradient monitoring wells while MW-101 and MW-102 are located hydraulically downgradient from the Marshall Plant Waste Pond.

As presented in Table 10, 12 parameters were detected at various concentrations above the criteria, including the identification of several compounds in the upgradient samples. Volatile organics were the most prevalent of the parameters detected in the upgradient well samples, with tetrachloroethylene noted at a maximum concentration of 200 parts per billion (ppb) at Monitoring Well MW-100. Cadmium and chromium were detected in upgradient Monitoring Well MW-5 at concentrations of 23 and 50 ppb, respectively, while p-dichlorobenzene was noted at 13 ppb at Monitoring Well MW-100.

Several compounds were detected at elevated levels in downgradient Monitoring Wells MW-101 and MW-102. Arsenic was detected at a maximum concentration of 30 ppb at Monitoring Well MW-102, while chromium was identified at levels of 320 and 370 ppb in Monitoring Wells MW-101 and MW-102, respectively. As shown in Table 10, volatile and semivolatile organics were also identified at elevated concentrations in the downgradient monitoring wells. The highest concentration of organics was detected at Monitoring Well MW-102. At this location, the data reveal 1,600 ppb of chloroform, 750 ppb of trichloroethylene, 200 ppb of tetrachloroethylene, 300 ppb of chlorobenzene, 230 ppb of 1,2,4-trichlorobenzene, 2,000 ppb of o-dichlorobenzene, and 2,000 ppb of p-dichlorobenzene.

A review of contaminant concentrations at those monitoring wells sampled within the immediate vicinity of the Marshall Plant Waste Pond confirm that groundwater beneath this SWMU is moving predominantly toward the north, in the general direction of a series of pumping wells. It does not appear that contaminants are migrating southwest toward the Ohio River.

4.2.2 Inorganic Waste Pond

Three new monitoring wells installed about the Inorganics Waste Pond were sampled during the Verification Investigation. Monitoring Well MW-105 was originally identified as an upgradient monitoring well relative to the Inorganics Waste Pond while Monitoring Wells MW-103 and MW-104 were selected as downgradient monitoring locations. However, as shown on Figure 1, groundwater flow direction in this general area as determined from the October 16, 1989 data reveals that at the time of sample collection, Monitoring Well MW-103 would most likely be considered as hydraulically upgradient with respect to the Inorganics Waste Pond while Monitoring Wells MW-104 and MW-105 would be hydraulically downgradient.

As summarized in Table 11, groundwater samples collected at this SWMU were analyzed for several total metals constituents as well as TOC and TOX. Of the total metals constituents analyzed, only selenium was not detected at any of the monitoring wells. Although the overall concentration of contaminants were lowest in upgradient Monitoring Well MW-103, the contaminants were still present at levels above the criteria. Although Monitoring Well MW-104 contained the fewest constituents, the concentrations of the constituents detected were high compared to the other monitoring wells (e.g., barium at 17,000 ppb, chromium at 650 ppb, and lead at 1,000 ppb). Arsenic and mercury were not detected at Monitoring Well MW-104. Groundwater samples obtained from Monitoring Well MW-105 revealed elevated concentrations of constituents as compared to those samples collected from Monitoring Well MW-103. Groundwater samples submitted for TOC and TOX analysis revealed that these parameters were present at relatively low concentrations, between the range of 5 to 9 parts per million (ppm).

As suggested on the groundwater contour map (Figure 1) the Inorganics Waste Pond is located near a groundwater divide. Thus, groundwater which may locally have an easterly component of movement beneath this SWMU would be quickly intercepted by the groundwater flow created by the pumping wells to the north and south.

4.2.3 Barium Waste Landfill

Groundwater samples were collected from four new monitoring wells strategically positioned about the Barium Waste Landfill. As shown in Figure 1, Monitoring Well MW-106 was identified as an upgradient monitoring point while Monitoring Wells MW-108 and MW-109 were identified as downgradient from the Barium Waste Landfill. The location for Monitoring Well MW-107 was selected based on the groundwater contour map prepared from the April 13, 1989 groundwater elevation data which suggested that there may be a local migration of groundwater away from this SWMU to the east, outside of the influence of Pumping Wells

Nos. 50, 51, 53, and 57. Therefore, Monitoring Well MW-107 is also considered to be a downgradient monitoring well.

As presented in Table 12, there were no volatile organics detected at any of the monitoring wells sampled. Similarly, TOC was noted at relatively low (e.g., 4 to 7 ppm) concentrations in each of the samples analyzed. Analyses for total metals, however, revealed that barium and lead were present at elevated concentrations at each of the monitoring wells, including upgradient Monitoring Well MW-106 where barium was detected at 23,000 ppb and lead at 1,100 ppb. At the downgradient monitoring wells, barium was detected at concentrations which ranged from 12,000 to 18,000 ppb while lead was detected at 510 to 1,700 ppb.

A review of the groundwater contour map (Figure 1) indicates that Monitoring Well MW-106 is located hydraulically upgradient with respect to the Barium Waste Landfill. Therefore, the presence of barium and lead at elevated concentrations in samples withdrawn from this well is most likely not attributed to groundwater migration.

4.2.4 Benzene Hexachloride (BHC) Waste Pile

Groundwater samples were collected from two new monitoring wells identified as Monitoring Wells MW-110 and MW-111 (Figure 1). Existing Monitoring Well MW-16 was also scheduled to be sampled due to its proximity to this SWMU; however, at the time of sample collection, an obstruction was noted within the well which prevented the collection of samples. During field activities, Monitoring Well MW-111 had to be repositioned as drilling operations at the original location encountered a filter-cake type material later identified as BHC.

Analytical results from the two monitoring wells sampled are summarized in Table 13. Monitoring Well MW-111, which would now be considered as upgradient with respect to the BHC Waste Pile, did not contain any volatile organics above the detection limits. Lead, however, was

detected at 130 ppb in this monitoring well. Analysis of the groundwater data obtained from Monitoring Well MW-110 shows the presence of lead at 350 ppb as well as elevated concentrations of several volatile organics (e.g., chloroform at 2,600 ppb, trichloroethylene at 110 ppb, tetrachloroethylene at 430 ppb, and trans-1,2-dichloroethylene at 110 ppb).

Although elevated levels of contaminants were detected in the immediate vicinity of the BHC Waste Pile, it is apparent that groundwater beneath this SWMU is being intercepted by Pumping Well No. 19 and may also be within the cone of influence produced by the series of pumping wells situated northwest of the BHC Waste Pile (e.g., Nos. 10, 40, 41, 8, and 39). Groundwater potentially contaminated by this SWMU does not appear to be migrating towards the Ohio River.

4.2.5 Fly Ash Landfill

Due to the aerial extent of the Fly Ash Landfill SWMU, five monitoring wells were installed. Two upgradient monitoring wells identified as Monitoring Wells MW-112 and MW-113 were positioned along the western border of the two units, while downgradient wells identified as Monitoring Wells MW-114, MW-115, and MW-116 were located along the eastern borders of the two units (Figure 1).

Groundwater samples collected from these monitoring wells were analyzed for barium and iron (total metals) as well as for sulfate concentration, total alkalinity, and pH. A summary of the analytical data is presented in Table 14. The presence of barium was reported at concentrations above that specified in the RCRA permit at all sample locations. The highest concentrations are at monitoring well locations MW-112 (1,300 ppb), MW-114 (1,300 ppb), and MW-116 (3,900 ppb) which, as shown in Figure 1, are located in the southern half of the SWMU. It should be noted that barium was detected at a concentration of 372 ppm during an analysis for trace metals in the fly ash material (June 14, 1988).

These data suggest that the fly ash itself may be a contributor to the elevated levels of barium detected in the groundwater samples. High alkalinity (pH of 12.09) was reported at Monitoring Well MW-115, and acidic samples were collected at Monitoring Wells MW-112 and MW-113 (pH of 5.47 and 5.80, respectively).

Groundwater movement beneath this SWMU is predominantly to the east-southeast, towards the pumping wells. It appears that there may be a localized component of flow in the vicinity of Monitoring Well MW-112, which is toward the Ohio River. This may be a result of groundwater mounding, a phenomenon which often occurs in landfilled areas. The suggestion of some groundwater movement toward the river is further substantiated by the elevated concentrations of barium detected at Monitoring Well MW-112.

4.2.6 Sanitary Landfill

Two monitoring wells were sampled at this SWMU; existing Monitoring Well MW-32 was selected as an upgradient monitoring location, while Monitoring Well MW-117 was installed to serve as a downgradient monitoring well with respect to the Sanitary Landfill (Figure 1).

Groundwater samples collected from these two wells were analyzed for the presence of several volatile and semivolatile compounds. As summarized in Table 15, the upgradient monitoring well (MW-32) did not contain any of the selected compounds above the detection limits. In the downgradient well (MW-117), two volatile organics were detected at concentrations slightly above the criteria. Trichloroethene was identified at 27 ppb, and tetrachloroethene was identified at 32 ppb at this location.

As shown on the groundwater contour map (Figure 1), groundwater movement beneath this portion of the facility is to the southeast towards the production wells.

4.2.7 Mercury Wastewater Collection Tanks

Three groundwater monitoring wells were installed and sampled in the vicinity of the Mercury Wastewater Collection Tanks. Existing Monitoring Well MW-10 was scheduled to be sampled during the Verification Investigation. However, this well was found to be damaged beyond use at the time of groundwater sampling activities. Monitoring Well MW-118 was originally identified as an upgradient monitoring location and Monitoring Wells MW-119 and MW-120 identified as downgradient monitoring locations with respect to this SWMU. As shown in Figure 1, the groundwater gradient in the general vicinity of this SWMU is very flat. However, examination of the groundwater contour map reveals that the general movement of groundwater is west-northwest, toward the production well. Therefore, Monitoring Well MW-118 cannot truly be considered upgradient.

As summarized in Table 16, mercury, the only compound analyzed for, was detected in each monitoring well at levels above the criteria. As with the other SWMUs investigated during this study, groundwater beneath this SWMU is moving toward the center of the plant as it is drawn toward the production wells.

4.3 CONTAMINANT OCCURRENCE IN SOIL

Soil samples were collected at the Mercury Wastewater Collection Tanks SWMU during the Verification Investigation. Soil samples were collected on September 20, 21, and 26, 1989 in conjunction with the installation of monitoring wells at this SWMU. The methodology incorporated in the collection of soil samples is discussed in Section 3.4.2 of this report. Analytical data sheets, QA/QC documentation, and method references are provided in Appendix D.

4.3.1 Mercury Wastewater Collection Tanks

Nine soil samples were analyzed for the presence of mercury at this SWMU. Three of these samples, SS-1, SS-2, and SS-3, were surface soil

samples collected at strategic locations about the Mercury Wastewater Collection Tanks while the other six samples were collected during the advancement of the boreholes which were drilled for the installation of Monitoring Wells MW-118, MW-119, and MW-120. Soil sampling locations are presented in Figure 2.

As summarized in Table 17, mercury was detected in several soil samples above the criteria (1.0 ppm). In the surface soil samples, mercury was detected in each sample at levels which ranged from 7.1 to 90 ppm, with the highest concentration noted in Sample SS-1, which was topographically low with respect to the containment tanks. As discussed in Section 3.4.2 of this report, soil samples were collected at two intervals during advancement of boreholes in this area. The first samples (identified with suffix-01) were collected at depths of 6 to 12 inches below ground surface while the second samples (identified with suffix-02) were collected at a depth just above the water table. Those soil samples collected immediately above the water table did not reveal the presence of mercury above the 1.0 ppm criteria as defined in the permit. The maximum mercury concentration in this sample interval was 0.7 ppm, as noted at Location MW-118-02. However, mercury was noted at elevated levels in the near surface at two of the three groundwater monitoring locations. Sample MW-118-01 revealed a mercury concentration of 750 ppm while Sample MW-119-01 showed mercury at a level of 130 ppm.

5.0 CONCLUSIONS

The Verification Investigation was conducted at the PPG Natrium plant to determine whether releases have or have not occurred from the seven SWMUs. Specifically, a groundwater investigation was to be implemented, the results of which could be used to determine whether further investigation or remediation would be warranted. To accomplish this objective, groundwater monitoring wells installed at strategic locations with respect to each SWMU were sampled and analyzed for unit specific parameters as outlined in Part II.B.1.b(3) of the facility's RCRA permit (No. WVD 00 433 6343). Analytical results obtained from these samples were then compared against the groundwater concentration criteria listed for each parameter in Part II.B.1.b(4) of the permit to determine if further investigation would be warranted at each SWMU.

5.1 PARAMETER CONCENTRATION

As discussed in Section 4.2 of this report, specific parameters analyzed for were identified in the groundwater samples collected about each of the SWMUs at variable concentrations. At each SWMU at least one (and often several) constituent was identified at a level which was in excess of the concentration limit designated for that parameter in the RCRA permit.

5.2 GROUNDWATER FLOW DIRECTION

As described in Section 4.1 of this report, groundwater flow at the PPG Natrium plant is controlled by the industrial pumping wells located throughout the facility. At each of the SWMUs investigated during this study, groundwater movement was predominantly toward the center of the plant due to the influence of the production wells. One exception to this trend is near the western border of the Fly Ash Landfill, where a groundwater mounding feature was identified. This phenomenon may result in a localized component of flow toward the Ohio River.

As the production wells are scheduled to remain in operation at their current capacity throughout the life the of the plant, it is reasonable to assume that groundwater will continue to migrate toward the center of the plant. Therefore, based on the groundwater contour map derived from the October 16, 1989 data (Figure 1), groundwater is not migrating off site, and an extensive RCRA Facility Investigation (RFI) is not warranted at this time. However, groundwater movement will continue to be monitored in the future to ensure that contaminated groundwater is not migrating off site. This will be accomplished through the implementation of a perimeter monitoring well program as outlined in Chapter 6.0 of this report.

6.0 RECOMMENDATIONS

6.1 PERIMETER MONITORING SYSTEM

To ensure that contaminated groundwater is not migrating off site, an expanded groundwater monitoring program is recommended. As presented in Figure 3, the program would involve the monitoring of perimeter wells which are strategically located at the PPG Natrium facility along the Ohio River and to the north and south of the facility. This program would involve the installation of four additional monitoring wells (constructed in the same manner as those installed for the verification investigation) and incorporate ten existing monitoring wells. Included in the perimeter monitoring system will be Monitoring Well MW-112, located in the immediate vicinity of the groundwater mound identified near the Fly Ash Landfill. Based on the present knowledge of groundwater movement in the vicinity of the PPG Natrium facility, the perimeter monitoring system will only address those areas to the immediate north and south ends of the plant property and along the Ohio River. No perimeter groundwater monitoring will be performed along the eastern edge of the PPG plant due to the steep natural groundwater gradient which slopes toward the production area along this side of the site. Additionally, PPG owns the property immediately east of the plant, including the hill and the next valley (with the exception of State Route 2), and therefore, there is no threat of groundwater migrating off site in an easterly direction.

The perimeter wells would be sampled quarterly for one-year so that a data base may be established and so that seasonal variations may be accounted for. Thereafter, the wells would be sampled semiannually to monitor for statistically significant increases in contaminant levels. Groundwater level measurements would be recorded at all of the Natrium plant monitoring wells during each sampling event and groundwater contour maps prepared. In this manner, deviations from the historic direction of the groundwater movement may be noted and the monitoring system adjusted accordingly.

6.2 PARAMETERS FOR ANALYSIS

The perimeter wells would be monitored for the parameters associated with each SWMU which would most likely impact that monitoring well (e.g., Monitoring Well MW-31 would be analyzed for constituents associated with the Sanitary Landfill). A summary of the proposed perimeter wells and the respective SWMUs to which they would most likely be associated with are presented in Table 18. Parameters associated with each SWMU, and which will be analyzed for during the perimeter monitoring program, may be found in Table 6.

In the event that the perimeter monitoring program reveals a significant increase in contaminant levels or suggests that groundwater may be migrating off site, the monitoring well network would be redesigned and/or additional corrective action proposed.

6.3 FLY ASH LANDFILL INSPECTION AND REPAIR PROCEDURES

As directed in Section II.B.2 of the RCRA permit, PPG is required to submit a description of the procedures used to inspect the soil cap and embankment sides of the Fly Ash Landfill SWMU in the event that barium concentrations in the downgradient groundwater samples (e.g., Monitoring Wells MW-114, MW-115, and MW-116) equal or exceed 1 ppm. Similarly, in the event that deficiencies are noted in the cap or berm during an inspection, PPG has been directed to describe the repair procedures to be implemented to prevent the release of hazardous constituents during heavy rainfall or flooding.

Presently, a stockpile of clay fill materials is maintained in an accessible area on top of the covered fly ash landfill (above the 100-year flood plain of 642 feet) for emergency maintenance of berm and cap deficiencies. This material was obtained from the same source as that material used in construction of the dikes and has a hydraulic conductivity in the range of 3×10^{-7} to 5×10^{-8} cm/s (Table 19). This material will be used for repairs should inspection of the cap and embankment reveal deficiencies.

It is recommended that the downgradient monitoring wells be resampled as the barium concentrations were just above the limit requiring implementation of an inspection and repair program. Should barium be detected at levels which exceed the 1 ppm limit, initiate the following inspection procedure on a quarterly basis:

Environmental personnel from the PPG Natrium Plant will inspect the cover and berms for visual signs of damage including:

- Sparse (i.e., less than 50 percent) vegetation
- Erosion (furrows greater than four inches wide and/or four inches deep)
- Burrowing animals
- Ponded water.

If the above deficiencies are noted during an inspection, the following corrective actions would be implemented:

- Replace topsoil, fertilize, and seed
- Repair with clay, topsoil, and seed
- Bait and/or trap animals, fill holes, and seed
- Fill to regrade, replace topsoil, and seed.

In addition to the quarterly inspection and maintenance program, the downgradient monitoring wells would be sampled twice per year and tested for barium. Should the monitoring wells begin to reveal significantly elevated concentrations of barium, the inspection and maintenance program will be reevaluated and appropriate corrective actions taken.

TABLES

TABLE 1
SOLID WASTE MANAGEMENT UNIT CHARACTERIZATION
PPG INC.
NATRIUM PLANT
NEW MARTINSVILLE, WEST VIRGINIA

SOLID WASTE MANAGEMENT UNIT	SIZE (ft)	VOLUME (1,000 ft ³)	DEPTH (ft)	WASTE DESCRIPTION ^a	NOTES ^a
Marshall Plant Pond (SWMU No. 5)	275 x 220	485	~8	<ul style="list-style-type: none"> • Ferric chloride (FeCl₄) 2,760,000 pounds • Chlorinated benzenes and tar • Metals (Fe, Mn, Mg, Zn Cd, Cu, V, Cr) • Tracifier waste <ul style="list-style-type: none"> - Halogenated aliphatics - Inorganic salts - CCl₄ 	<ul style="list-style-type: none"> • Walls and bottom constructed of local clay • Received waste from <ul style="list-style-type: none"> - Chlor-alkali plant - Chlorinated benzene plant - Titanium tetrachloride plant • Closure in 1979-80 <ul style="list-style-type: none"> - six to eight-inch clay - Includes concrete material under clay layer • Ponds in area of silty clay soil
Inorganics Waste Pond (SWMU No. 6)	225 x 140	190	~6	<ul style="list-style-type: none"> • BaCO₃ • BaSO₄ • Fe₂O₃ • SiO₂ 	<ul style="list-style-type: none"> • Walls and bottom of earthen material • Received wastewater and sludge from barium oxide plant • Closure in 1980, six to eight- inch clay and soil • Located near groundwater divide produced by pumping (1985 data) • Pond in area of suspected fill material
Barium Waste Landfill (SWMU No. 7)	200 x 200	150	~4	<ul style="list-style-type: none"> • BaCO₃ • BaSO₄ • Fe₂O₃ • SiO₂ 	<ul style="list-style-type: none"> • Constructed of local top soil and clay • Received solid wastes from barium plant • Closure in 1980; six-inch soil cover

See footnote at end of table.

TABLE 1
(Continued)

SOLID WASTE MANAGEMENT UNIT	SIZE (ft)	VOLUME (1,000 ft ³)	DEPTH (ft)	WASTE DESCRIPTION ^a	NOTES ^a
BHC Waste Pile (SWMU No. 8)	75 x 150	50	~20	<ul style="list-style-type: none"> • Benzene hexachloride isomers (a, b, q, BHC) • Chlorinated organic solvents (trace) 	<ul style="list-style-type: none"> • Open waste pile on soil or fill • Received waste product from BHC plant • Material shipped off site in 1977 • No formal closure
Fly Ash Landfill (SWMU No. 10)	300 x 1,800	4,725	~11	<ul style="list-style-type: none"> • BaSO₄ • BaCO₃ • Fe₂O₃ • SiO₂ 	<ul style="list-style-type: none"> • Constructed with clay bottom and dikes • Received: <ul style="list-style-type: none"> - Bottom ash prior to 1975 - Fly and bottom ash since 1975 • Progressive closure as areas become filled • Periodic barium waste deposited in southern tracts • Closure consists of six-inch soil and grass • Landfill constructed in area of clay approximately 20 feet thick • Scrap metal may be present
Sanitary Landfill (SWMU No. 11)	1,100 x 500	5,500	-	<ul style="list-style-type: none"> • General trash and rubbish • Demolition debris • Construction refuse 	<ul style="list-style-type: none"> • Constructed in sandy-clay loam material • Three separate cells; two closed • Class III nonchemical landfill
Mercury Wastewater Tanks (SWMU No. 14)	-	-	-	<ul style="list-style-type: none"> • Mercuric sulfide • Mercuric chloride 	<ul style="list-style-type: none"> • Consists of three tanks and treatment system • Treatment results in insoluble ground mercuric sulfide which is disposed off site • Mercury has been detected in nearby monitoring wells

^aInformation based on 1985 and 1986 submittals by PPG to U.S. EPA.

TABLE 2
GROUNDWATER MONITORING WELL SURVEY DATA

MONITORING WELL NO. ^a	NORTH PLANT COORDINATE	EAST PLANT COORDINATE	GROUND SURFACE ELEVATION (ft)	TOP OF PROTECTIVE CASING ELEVATION (ft)	TOP OF PVC CASING ELEVATION (ft)
MW-100	2017.029	-806.675	635.326	638.297	638.102
MW-101	1985.635	-593.920	639.017	641.794	641.630
MW-102	2268.853	-563.538	640.101	643.547	643.409
MW-103	-1740.729	-172.146	645.942	648.988	648.854
MW-104	-1999.332	39.706	647.531	650.811	650.616
MW-105	-1728.538	-33.710	647.581	650.558	650.400
MW-106	-4522.450	-767.387	637.478	640.022	639.877
MW-107	-4585.288	-601.810	638.589	641.329	641.190
MW-108	-4247.689	-741.818	641.503	644.182	644.034
MW-109	-4221.067	-575.809	647.867	650.870	650.735
MW-110	-2769.356	-675.606	636.354	639.668	639.067
MW-111	-2972.943	-607.009	630.537	630.907	630.539
MW-112	2929.619	-768.067	632.989	635.693	635.485
MW-113	4162.680	-486.488	633.999	637.145	636.891
MW-114	3072.288	-487.282	637.670	640.834	640.610
MW-115	3938.791	-298.750	638.540	641.326	641.140
MW-116	2536.958	-537.086	638.729	641.796	641.649
MW-117	3337.530	-42.187	652.525	655.656	655.492
MW-118	280.833	-43.575	657.339	660.100	659.859
MW-119	298.986	121.745	671.326	671.548	671.174
MW-120	212.017	65.205	671.630	671.864	671.487

^aRefer to Figure 1 for monitoring well locations.

TABLE 3
GROUNDWATER MONITORING WELL
UNIVERSAL TRANSVERSE MERCATOR COORDINATES

MONITORING WELL NO. ^a	NORTH COORDINATE	EAST COORDINATE
100	4399904.7913	512112.2603
101	4399940.3795	512167.2611
102	4400011.7478	512118.0135
103	4399164.1023	513006.8502
104	4399146.5847	513107.2314
105	4399194.4244	513036.4428
106	4398396.6717	513429.5550
107	4398422.0329	513474.2136
108	4398472.2168	513374.6819
109	4398511.4157	513407.6578
110	4398826.3310	513095.5357
111	4398792.8170	515151.5044
112	4400123.4367	511938.9590
113	4400463.7057	511758.8571
114	4400211.7939	511975.7234
115	4400449.3437	511846.6381
116	4400078.5164	512070.8157
117	4400361.7564	512025.7390
118	4399655.7714	512634.4362
119	4399693.1086	512669.0183
120	4399661.5473	512673.1099

^aRefer to Figure 1 for monitoring well locations.

TABLE 4
MONITORING WELL DATA AND GROUNDWATER ELEVATIONS
PPG, INC.
NATRIUM CHEMICAL PLANT
NEW MARTINSVILLE, WEST VIRGINIA

WELL NO. ^a	ELEVATION OF TOP OF PVC (ft above MSL)	DEPTH TO WATER FROM TOP OF PVC (ft) (10-16-89)	WATER TABLE ELEVATION (ft above msl) (10-16-89)	SCREEN LENGTH (ft)	TOP OF SCREEN ELEVATION (ft above msl)	BOTTOM OF SCREEN ELEVATION (ft above msl)	CONDITION (plugged, damaged, usable)
MW-1	690.99	36.68	654.31	10.0	646.49	636.49	Usable
MW-2	687.44	71.48	615.98	30.0	618.44	588.44	Usable
MW-3	640.30	NA	NA	30.0	618.80	588.80	Usable
MW-4	637.16	NA	NA	40.0	619.66	579.66	Usable
MW-5	629.57	5.22	624.35	10.0	619.57	609.57	Usable
MW-6	646.89	32.20	614.69	40.0	611.39	571.39	Usable
MW-7	654.58	39.41	615.17	40.0	610.08	570.08	Usable
MW-8	657.86	42.43	615.43	40.0	613.36	573.36	Usable
MW-9	668.46	52.82	615.64	40.0	624.46	584.46	Usable
MW-10	673.59	57.67	615.92	30.0	611.59	581.59	Damaged
MW-11	671.56	55.25	616.31	30.0	610.06	580.06	Usable
MW-12	673.02	56.47	616.55	30.0	613.52	583.52	Damaged
MW-13	667.56	50.23	617.33	30.0	612.26	582.26	Damaged
MW-14	649.10	31.95	617.15	37.0	617.10	580.10	Usable
MW-15	646.01	NA	NA	40.0	614.51	574.51	Plugged
MW-16	642.18	23.22	616.96	43.0	619.48	576.48	Damaged

See footnote at end of table.

TABLE 4
(Continued)

WELL NO. ^a	ELEVATION OF TOP OF PVC (ft above MSL)	DEPTH TO WATER FROM TOP OF PVC (ft) (10-16-89)	WATER TABLE ELEVATION (ft above msl) (10-16-89)	SCREEN LENGTH (ft)	TOP OF SCREEN ELEVATION (ft above msl)	BOTTOM OF SCREEN ELEVATION (ft above msl)	CONDITION (plugged, damaged, usable)
MW-17	641.85	24.51	617.34	40.0	614.35	574.35	Usable
MW-18	641.87	24.04	617.83	40.0	615.87	575.87	Usable
MW-19	667.92	50.98	616.94	40.0	617.42	577.42	Usable
MW-30	657.42	41.92	615.50	20.0	617.92	597.72	Usable
MW-31	674.28	59.06	615.22	20.0	617.78	597.78	Usable
MW-32	658.86	43.67	615.19	20.0	616.86	596.86	Usable
MW-33	667.61	52.81	614.80	20.0	616.11	596.11	Usable
MW-100	638.10	13.89	624.21	20.0	624.21	604.21	Usable
MW-101	641.63	25.65	615.98	20.0	618.93	598.93	Usable
MW-102	643.41	27.73	615.68	20.0	620.50	600.50	Usable
MW-103	648.85	30.67	618.18	20.0	620.09	600.09	Usable
MW-104	650.62	33.31	617.31	20.0	630.47	610.47	Usable
MW-105	650.40	32.22	618.18	20.0	621.65	601.65	Usable
MW-106	639.88	23.25	616.63	20.0	627.56	607.56	Usable
MW-107	641.19	24.61	616.58	20.0	629.98	609.98	Usable
MW-108	644.03	28.25	615.78	20.0	626.09	606.09	Usable
MW-109	650.74	35.04	615.70	20.0	622.74	602.74	Usable
MW-110	639.07	16.35	622.72	20.0	625.00	605.00	Usable

See footnote at end of table.

TABLE 4
(Continued)

WELL NO. ^a	ELEVATION OF TOP OF PVC (ft above MSL)	DEPTH TO WATER FROM TOP OF PVC (ft) (10-16-89)	WATER TABLE ELEVATION (ft above msl) (10-16-89)	SCREEN LENGTH (ft)	TOP OF SCREEN ELEVATION (ft above msl)	BOTTOM OF SCREEN ELEVATION (ft above msl)	CONDITION (plugged, damaged, usable)
MW-111	630.54	6.07	624.47	15.0	626.34	611.34	Usable
MW-112	635.49	10.37	625.12	20.0	621.94	601.94	Usable
MW-113	636.89	13.30	623.59	20.0	619.89	599.89	Usable
MW-114	640.62	25.25	615.34	20.0	619.62	599.62	Usable
MW-115	641.14	25.15	615.99	20.0	617.73	597.73	Usable
MW-116	641.65	26.06	615.59	20.0	619.90	599.90	Usable
MW-117	655.49	40.22	615.27	20.0	616.97	596.97	Usable
MW-118	659.86	43.61	616.25	20.0	617.17	597.17	Usable
MW-119	671.17	54.96	616.21	20.0	624.62	604.62	Usable
MW-120	671.49	55.19	616.30	20.0	622.33	602.33	Usable
MW-121	639.50	18.66	620.84	20.0	626.49	606.49	Usable
MW-122	637.31	19.96	617.35	20.0	623.72	603.72	Usable

^aRefer to Figure 1 for monitoring well locations.

TABLE 5
SOIL SAMPLE IDENTIFICATIONS
SWMU NO. 14
PPG, INC.
NATRIUM PLANT
NEW MARTINSVILLE, WEST VIRGINIA

SAMPLE IDENTIFICATION ^a	DESCRIPTION	SAMPLE DEPTH (ft below ground surface)
SS-1	Downgradient surface soil sample	(0.5-1.0)
SS-2	Downgradient surface soil sample	(0.5-1.0)
SS-3	Upgradient surface soil sample	(0.5-1.0)
MW-118-01	Surface soil sample collected during advancement of Borehole MW-118	(0.5-1.0)
MW-118-02	Soil sample collected just above ground-water table at Borehole MW-118	(40.0-41.0)
MW-119-01	Surface soil sample collected during advancement of Borehole MW-119	(0.5-1.0)
MW-119-02	Soil sample collected just above ground-water table at Borehole MW-119	(45.0-46.0)
MW-120-01	Surface soil sample collected during advancement of Borehole MW-120	(0.5-1.0)
MW-120-02	Soil sample collected just above ground-water table at Borehole MW-120	(45.0-46.0)

^aRefer to Figure 2 for soil sample locations.

TABLE 6
 U.S. EPA-REQUESTED PARAMETERS FOR GROUNDWATER ANALYSIS
 PPG, INC.
 NATRIUM PLANT
 NEW MARTINSVILLE, WEST VIRGINIA

SWMU	U.S. EPA-REQUESTED PARAMETERS
Marshall Plant Pond	Inorganics: Cd, As, Cr, Organics: Chloroform Methylene chloride Carbon tetrachloride Trichloroethane Benzene Trichloroethylene Tetrachloroethylene m-, p-, and o-dichlorobenzene Trichlorobenzene Benz(a)anthracene Benzo(b)fluoranthene Benzo(a)pyrene Chlorinated naphthalene Chlorobenzene Dibenz(a,h)anthracene 7,12-Dimethylbenz(a)anthracene 3-Methylcholanthrene Naphthalene Fluoranthene
Inorganics Waste Pond	Inorganics: As, Ba, Cr, Fe, Pb, Hg, Se Organics: Total organic carbon (TOC) Total organic halogen (TOX)
Barium Waste Landfill	Inorganics: Pb, Ba Organics: Total organic carbon (TOC) Benzene Carbon tetrachloride
BHC Waste Pile	Inorganics: Pb Organics: Chloroform Carbon tetrachloride trans-1,2-dichloroethylene Bromo dichloromethane Trichloroethylene Tetrachloroethylene Benzene

See footnote at end of table.

TABLE 6
(Continued)

SWMU	U.S. EPA-REQUESTED PARAMETERS
Fly Ash Landfill	Inorganics: Ba, Fe, Sulfate Total alkalinity pH
Sanitary Landfill	Organics: Chloroform Methylene chloride Carbon tetrachloride Trichloroethane Benzene Trichloroethylene Tetrachloroethylene m-, p-, and o-dichlorobenzene
Mercury Wastewater Tanks	Inorganics: Hg ^a

^aSix soil samples collected from boreholes drilled for the installation of monitoring wells at this SWMU will also be analyzed for the presence of mercury.

TABLE 7
ANALYTICAL DETECTION LIMITS

PARAMETER	DETECTION LIMIT GROUNDWATER ($\mu\text{g}/\ell$) ^a	DETECTION LIMIT SOIL (mg/kg) ^b
Arsenic	10	1
Barium	200	
Cadmium	5	
Chromium	10	
Lead	5	
Mercury	0.2	1
Selenium	5	
Benzene	5	
Carbon tetrachloride	5	
Chlorobenzene	5	
Chloroform	5	
m-dichlorobenzene	10	
p-dichlorobenzene	10	
o-dichlorobenzene	10	
Fluoranthene	10	
Methylene chloride	5	
Naphthalene	10	
Trichlorobenzene	10	
Trichloroethane	5	
Trichloroethylene	5	
Tetrachloroethylene	5	
Trans-1,2-dichloroethylene	5	
Bromo dichloromethane	5	
Benz(a)anthracene	10	
Benzo(b)fluoranthene	10	
Benzo(a)pyrene	10	
Chlorinated naphthalene	10	
Dibenz(a,h)anthracene	10	
7,12-dimethylbenz(a)anthracene	10	
3-methylcholanthrene	10	

^a $\mu\text{g}/\ell$ = Micrograms per liter or parts per billion.

^bmg/kg = Milligrams per kilogram or parts per million.

TABLE 8
ANALYTICAL DETECTION METHODS

PARAMETER	METHOD
<u>Groundwater</u>	
Metals	
Arsenic	U.S. EPA 206.2
Barium	U.S. EPA 200.7
Cadmium	U.S. EPA 200.7
Lead	U.S. EPA 200.7 or 239.2
Mercury	U.S. EPA 245.1
Selenium	U.S. EPA 270.2
Total Chromium	SW846 7190
Iron	SW846 7380
Total Metal Digestion	CLP SOW 7/88
Organics	
Volatiles	SW846 8240
Semivolatiles	SW846 8270
General Chemistry	
Sulfate	SW846 9038
TOC	SW846 9060
TOX	SW846 9020
Alkalinity	U.S. EPA 310.1
<u>Soils</u>	
Metals	
Mercury	SW846 7471

TABLE 9
HYDRAULIC CONDUCTIVITIES

MONITORING WELL NO.	HYDRAULIC CONDUCTIVITY	
	(cm/s)	(ft/day)
MW-100	6.4×10^{-4}	1.8
MW-101	1.9×10^{-5}	0.1
MW-102	7.8×10^{-3}	22.2
MW-103	8.5×10^{-3}	24.3
MW-104	3.7×10^{-3}	10.3
MW-105	3.0×10^{-3}	8.6
MW-106	3.9×10^{-3}	11.1
MW-107	1.7×10^{-2}	46.1
MW-108	1.3×10^{-2}	36.4
MW-109	9.9×10^{-3}	26.7
MW-110	1.5×10^{-3}	4.3
MW-111	9.1×10^{-4}	2.6
MW-112	8.1×10^{-3}	23.1
MW-113	2.7×10^{-3}	7.6
MW-114	8.7×10^{-3}	24.8
MW-115	1.1×10^{-3}	3.0
MW-116	7.0×10^{-5}	6.1
MW-117	9.1×10^{-3}	25.6
MW-118	1.9×10^{-3}	5.3
MW-119	3.2×10^{-3}	9.2
MW-120	9.2×10^{-3}	26.1

TABLE 10
MARSHALL PLANT WASTE POND
GROUNDWATER ANALYTICAL RESULTS
PPG INDUSTRIES, INC.
NATRIUM PLANT
NEW MARTINSVILLE, WEST VIRGINIA

PARAMETER	CRITERIA (µg/ℓ)	SAMPLE IDENTIFICATION			
		MW-5	MW-100	MW-101	MW-102
(Concentration [µg/ℓ])					
<u>Total Metals</u>					
Arsenic	10	ND10	ND10	10	30
Cadmium	5	23	ND5	ND5	ND5
Chromium	10	50	ND10	320	370
<u>Volatile Organic Compounds</u>					
Methylene Chloride	5	ND5	ND5	ND50	ND100
Chloroform	5	ND5	120	1,500	1,600
1,1,1-Trichloroethane	5	ND5	ND5	ND50	ND100
Carbon Tetrachloride	5	ND5	15	ND50	ND100
Trichloroethylene	5	44	60	ND50	750
Benzene	5	ND5	ND5	ND50	ND100
Tetrachloroethylene	5	8	200	140	200
Chlorobenzene	5	ND5	ND5	410	300
<u>Semivolatile Organic Compounds</u>					
1,2,4-Trichlorobenzene	10	ND10	ND10	64	230
Benzo(a)anthracene	10	ND10	ND10	ND20	ND200
Benzo(b)anthracene	10	ND10	ND10	ND20	ND200
Benzo(a)pyrene	10	ND10	ND10	ND20	ND200
2-Chloronaphthalene	10	ND10	ND10	ND20	ND200
o-Dichlorobenzene	10	ND10	ND10	260	2,000
m-Dichlorobenzene	10	ND10	ND10	ND20	ND200
p-Dichlorobenzene	10	ND10	ND13	180	2,000
7,12-Dimethylbenz(a)anthracene	10	ND10	ND10	ND100	ND1000
3-Methylcholanthrene	10	ND10	ND10	ND100	ND1000
Dibenz(a,h)anthracene	10	ND10	ND10	ND20	ND200
Naphthalene	10	ND10	ND10	ND20	ND200
Fluoranthene	10	ND10	ND10	ND20	ND200

ND = Denotes that the compound is not detected at or above the detection limit shown.

TABLE 11
 INORGANICS WASTE POND
 GROUNDWATER ANALYTICAL RESULTS
 PPG INDUSTRIES, INC.
 NATRIUM PLANT
 NEW MARTINSVILLE, WEST VIRGINIA

PARAMETER	CRITERIA ($\mu\text{g}/\ell$)	SAMPLE IDENTIFICATION		
		MW-103 (Concentration [$\mu\text{g}/\ell$])	MW-104	MW-105
<u>Total Metals</u>				
Arsenic	10	140	ND100	150
Barium	200	400	17,000	3,400
Chromium	10	160	650	300
Iron	NA	250,000	1,400,000	420,000
Lead	5	650	1,000	900
Mercury	0.2	4.5	ND0.5	1.2
Selenium	5	ND5	ND5	ND5
<u>Other Parameters</u>				
Total Organic Carbon (TOC)	NA	7,000	5,000	9,000
Total Organic Halides (TOX)	NA	90	60	50

$\mu\text{g}/\ell$ = Micrograms per liter or parts per billion.

NA = Not available in permit criteria.

ND = Denotes that the compound is not detected at or above the detection limit shown.

TABLE 12
 BARIUM WASTE LANDFILL
 GROUNDWATER ANALYTICAL RESULTS
 PPG INDUSTRIES, INC.
 NATRIUM PLANT
 NEW MARTINSVILLE, WEST VIRGINIA

PARAMETER	CRITERIA ($\mu\text{g}/\text{l}$)	SAMPLE IDENTIFICATION			
		MW-106	MW-107	MW-108	MW-109
		(Concentration [$\mu\text{g}/\text{l}$])			
<u>Total Metals</u>					
Barium	200	23,000	12,000	18,000	13,000
Lead	5	1,100	510	1,700	890
<u>Volatile Organic Compounds</u>					
Carbon Tetrachloride	5	ND5	ND5	ND5	ND5
Benzene	5	ND5	ND5	ND5	ND5
<u>Other Parameters</u>					
Total Organic Carbon (TOC)	NA	7,000	4,000	6,000	4,000

$\mu\text{g}/\text{l}$ = Micrograms per liter or parts per billion.

NA = Not available in permit criteria.

ND = Denotes that the compound is not detected at or above the detection limit shown.

TABLE 13
 BENZENE HEXACHLORIDE (BHC) WASTE PILE
 GROUNDWATER ANALYTICAL RESULTS
 PPG INDUSTRIES, INC.
 NATRIUM PLANT
 NEW MARTINSVILLE, WEST VIRGINIA

PARAMETER	CRITERIA ($\mu\text{g}/\ell$)	SAMPLE IDENTIFICATION	
		MW-110	MW-111
		(Concentration [$\mu\text{g}/\ell$])	
<u>Total Metals</u>			
Lead	5	350	130
<u>Volatile Organic Compounds</u>			
Chloroform	5	2,600	ND5
Carbon Tetrachloride	5	ND100	ND5
Trans-1,2-dichloroethylene	5	110	ND5
Bromo Dichloromethane	5	ND100	ND5
Trichloroethylene	5	110	ND5
Tetrachloroethylene	5	430	ND5
Benzene	5	ND100	ND5

$\mu\text{g}/\ell$ = Micrograms per liter or parts per billion.

ND = Denotes that the compound is not detected at or above the detection limit shown

TABLE 14
 FLY ASH LANDFILL
 GROUNDWATER ANALYTICAL RESULTS
 PPG INDUSTRIES, INC.
 NATRIUM PLANT
 NEW MARTINSVILLE, WEST VIRGINIA

PARAMETER	CRITERIA ($\mu\text{g}/\ell$)	MW-112	SAMPLE IDENTIFICATION			MW-116
			MW-113	MW-114	MW-115	
			(Concentration [$\mu\text{g}/\ell$])			
<u>Total Metals</u>						
Barium	200	1,300	300	1,300	900	3,900
Iron	NA	160,000	50,000	160,000	5,700	470,000
<u>Volatile Organic Compounds</u>						
Sulfate	NA	480,000	120,000	140,000	2,000	69,000
Total Alkalinity	NA	6,000	12,000	140,000	2,000,000	200,000
pH ^a	NA	5.47	5.80	6.26	12.09	8.77

^aValues for pH are unit-less.

$\mu\text{g}/\ell$ = Micrograms per liter or parts per billion.

NA = Not available in the permit criteria.

TABLE 15
 SANITARY LANDFILL
 GROUNDWATER ANALYTICAL RESULTS
 PPG INDUSTRIES, INC.
 NATRIUM PLANT
 NEW MARTINSVILLE, WEST VIRGINIA

PARAMETER	CRITERIA ($\mu\text{g}/\ell$)	SAMPLE IDENTIFICATION	
		MW-117 (Concentration [$\mu\text{g}/\ell$])	MW-32 (Concentration [$\mu\text{g}/\ell$])
<u>Volatile Organic Compounds</u>			
Methylene Chloride	5	ND5	ND5
Chloroform	5	ND5	ND5
1,1,1-Trichloroethane	5	ND5	ND5
Carbon Tetrachloride	5	ND5	ND5
Trichloroethene	5	27	ND5
Benzene	5	ND5	ND5
Tetrachloroethene	5	32	ND5
Chlorobenzene	5	ND5	ND5
<u>Semivolatile Organic Compounds</u>			
o-Dichlorobenzene	10	ND10	ND50
m-Dichlorobenzene	10	ND10	ND50
p-Dichlorobenzene	10	ND10	ND50

$\mu\text{g}/\ell$ = Micrograms per liter or parts per billion.

ND = Denotes that the compound is not detected at or above the detection limit shown

TABLE 16
MERCURY WASTEWATER COLLECTION TANKS
GROUNDWATER ANALYTICAL RESULTS
PPG INDUSTRIES, INC.
NATRIUM PLANT
NEW MARTINSVILLE, WEST VIRGINIA

PARAMETER	CRITERIA ($\mu\text{g}/\ell$)	SAMPLE IDENTIFICATION		
		MW-118	MW-119	MW-120
		(Concentration [$\mu\text{g}/\ell$])		
<u>Total Metals</u>				
Mercury	0.2	210	430	310

$\mu\text{g}/\ell$ = Micrograms per liter or parts per billion.

TABLE 17
 MERCURY WASTEWATER COLLECTION TANKS
 SOIL SAMPLE ANALYTICAL RESULTS
 PPG INDUSTRIES, INC.
 NATRIUM PLANT
 NEW MARTINSVILLE, WEST VIRGINIA

PARAMETER	CRITERIA (mg/kg)	MW-118-01	MW-118-02	SAMPLE IDENTIFICATION						
				MW-119-01	MW-119-02	MW-120-01	MW-120-02	SS-1	SS-2	SS-3
				(concentration [mg/kg])						
<u>Total Metals</u>										
Mercury	1.0	750 ^a	0.7	130	0.3	0.1	ND0.1	90	7.1	10

^aAverage of three runs

mg/kg = Milligrams per kilogram or parts per million

ND = Denotes that the compound is not detected at or above the detection limit shown.

TABLE 18
PROPOSED PERIMETER MONITORING WELLS
AND ASSOCIATED SWMUs
PPG INDUSTRIES, INC.
NATRIUM PLANT
NEW MARTINSVILLE, WEST VIRGINIA

MONITORING WELL NO. ^a	SOLID WASTE MANAGEMENT UNIT
31	Sanitary Landfill
113	Fly Ash Landfill
112	Fly Ash Landfill
5	Fly Ash Landfill, Marshall Plant Waste Pond
100	Marshall Plant Waste Pond
111	BHC Waste Pile
108	Barium Waste Landfill
106	Barium Waste Landfill
121	Barium Waste Landfill
122	Barium Waste Landfill
125	Sanitary Landfill, Fly Ash Landfill
126	Marshall Plant Waste Pond
127	BHC Waste Pile
128	BHC Waste Pile

^aRefer to Figure 3 for monitoring well locations.

TABLE 19
FLY ASH LANDFILL
PERMEABILITY TEST RESULTS
CLAY LINER, BERM, AND CAP MATERIAL
PPG INDUSTRIES, INC.
NATRIUM PLANT
NEW MARTINSVILLE, WEST VIRGINIA

SAMPLE NO.	DRY DENSITY (pcf)	MOISTURE CONTENT (%)	COMPACTION (%)	CONSTANT ^a HEAD (ft)	HYDRAULIC CONDUCTIVITY
1	120.7	11.1	95.1	16	1.502×10^{-8}
2	121.2	11.2	94.7	16	1.598×10^{-8}
3	112.6	13.1	94.9	8	4.529×10^{-8}
4	115.6	12.1	94.9	16	1.413×10^{-8}
5	117.3	11.1	94.9	8	3.313×10^{-7}

^aUnable to obtain measureable flows at eight-foot head on Sample Nos. 1, 2, and 4; increased head to 16 feet.

Notes:

1. Laboratory tests performed by Pittsburgh Testing Laboratory, Pittsburgh, Pennsylvania.
2. Data provided to IT Corporation by PPG Industries Inc.

FIGURES

1E	DRAWN BY	B. A. KUMPF	CHECKED BY	JAH	1-8-90	DRAWING NUMBER	303409-E4
21 NOV 89							

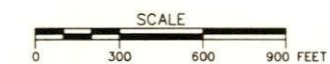


FIGURE 1

GROUNDWATER CONTOUR MAP
AS DERIVED FROM OCTOBER 16, 1989
GROUNDWATER ELEVATION DATA
NATRIUM CHEMICAL PLANT
NEW MARTINSVILLE, WEST VIRGINIA

PREPARED FOR

PPG INDUSTRIES, INC.
PITTSBURGH, PENNSYLVANIA



PAVED ROADWAY

MW-119

SS-3

MW-120

100' E

MERCURY WASTEWATER CONTAINMENT TANKS

SS-1

SS-2

SKYLINE DRIVE

MW-118

TRUE NORTH

PLANT NORTH

SCALE

0 30 60 FEET

N 300' E

N 100' E

LEGEND:

- SS-1
● SURFACE SOIL SAMPLE LOCATION
- MW-118
⊕ MONITORING WELL LOCATION
(2 SAMPLES PER LOCATION)
- STORAGE TANK

"Do Not Scale This Drawing"

PPG INDUSTRIES INC.
PITTSBURGH, PENNSYLVANIA

